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EXAMINER	
KOCH, GEORGE R	

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1791	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/609,634	KIMINO, KAZUNARI	
	Examiner	Art Unit	
	George R. Koch III	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 July 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *5,9,27,31,36 and 39-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5,9,27,31,36 and 39-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 7/16/2008 have been fully considered but they are not persuasive.

2. In response to applicant's argument that the prior art does not teach excepting or tip of the electrode, (or excluding a portion of the electrode), a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim.

3. In this case, the prior art references of Bouras and Ciardella are capable of being used to leave such a tip or portion uncovered.

4. Additionally, the manner of operating the device does not differentiate apparatus claim from the prior art. MPEP 2114. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). In this case, dispensing the resin to leave a tip or protrusion of the electrode exposed is considered to be a manner of operating the device and does not differentiate apparatus claims from the prior art.

5. Additionally, it is noted that the material or article worked upon does not limit apparatus claims. MPEP 2115. "Expressions relating the apparatus to contents thereof during an intended

operation are of no significance in determining patentability of the apparatus claim." *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969). Furthermore, "[i]nclusion of material or article worked upon by a structure being claimed does not impart patentability to the claims." *In re Young*, 75 F.2d *>996<, 25 USPQ 69 (CCPA 1935) (as restated in *In re Otto*, 312 F.2d 937, 136 USPQ 458, 459 (CCPA 1963)). In this case, semiconductor substrate and the electrode and its parameters (such as being protruding) are features of the material worked upon and do not limit the apparatus claims.

6. In any event, a series of alternative rejections which parallel the main rejections have been made, adding the Sahara reference (US patent 6,713,880). Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections

(see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excepted from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

Claim Rejections - 35 USC § 102

7. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 41-44 are rejected under 35 U.S.C. 102(b) as being anticipated by Ciardella (US 5,711,989).

As to claim 41, Ciardella discloses an apparatus (see Figure 2) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3 and 5) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is *capable* of being provided with at least one electrode formed on a first surface thereof, a discharging mechanism (Figure 4) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (see entire specification for numerous instances of viscous) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor

wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said viscous material (such as a raw sealant resin) is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The camera is capable of capturing the image prior to discharge. The apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. The apparatus of Ciardella is capable of performing the intended use of dispensing such that a resin layer having an uneven surface structure is formed from the raw sealant resin.

As to claims 42, 43, and 44, Ciardella is capable of being used to perform the operation of dispensing to form a concave structure, an uneven surface structure of predetermined shape, or an uneven surface structure which comprises a thickness of approximately 15 micrometers, having concave portions of approximately 20 micrometers deep.

9. Claims 36, 40, and 41-44 are rejected under 35 U.S.C. 102(b) as being anticipated by Bouras (US 5,906,682), as evidenced by Ciardella '777 (US 5,505,777). It should be noted that

the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras.

As to claim 36, Bouras, which discloses an improvement of Ciardella '777, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Ciardella '777 discloses the discharging head (nozzle 70 and subelements - see Figure 3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Bouras discloses that at least one electrode has a protruded shape (as seen in Figures 1 and 2). Additionally, Bouras and Ciardella '777 is capable of being used to control said discharging head and said drive mechanism such that the first surface of the semiconductor wafer is covered by said raw sealant resin except a tip portion of said protruded-shaped electrode.

As to claim 40, Bouras, which discloses an improvement of Ciardella '777, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Ciardella '777 discloses the discharging head (nozzle 70 and subelements - see Figure

3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Bouras (item 26) and Ciardella '777 disclose a heater (see column 6, lines 64-67 and column 7, lines 1-19) for heating said raw sealant resin contained in said resin container unit.

As to claim 41, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said

semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36). The apparatus of Bouras is capable of performing the intended use of dispensing such that a resin layer having an uneven surface structure is formed from the raw sealant resin.

As to claims 42, 43, and 44, Bouras is capable of being used to perform the operation of dispensing to form a concave structure, an uneven surface structure of predetermined shape, or an uneven surface structure which comprises a thickness of approximately 15 micrometers, having concave portions of approximately 20 micrometers deep.

Claim Rejections - 35 USC § 103

10. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

11. Claims 5, 9, 27 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989), and Nakazawa (US 5,935,375).

As to claim 5 and 27, Ciardella discloses an apparatus (see Figure 5) for manufacturing a semiconductor device, comprising: a substrate holding unit/means (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22) which is explicitly means for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism or means (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit or means (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device or means for (item 16 and 44) that captures and provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim,

such as the position. The camera is capable of capturing the image prior to discharge. The apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin.

Ciardella does not disclose that said discharging mechanism is provided with a plurality of discharging nozzles.

Nakazawa discloses using a discharging mechanism is provided with a plurality of discharging nozzles (see Figures 7A, 7B, 8A, and 8B). Nakazawa discloses that different nozzle sizes can be used in order minimize the differences in the rate of resin dispensing, so that the formation of resin-less voids is deterred (column 4, lines 26-45). The discharging nozzle of Nakazawa meet the limitation of being two different kinds of discharging mechanisms, heads or means. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized multiple nozzles as in Nakazawa in order to avoid resin-less voids.

As to claim 9, the control unit of Ciardella capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 9 above.

12. Claim 36 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989) and further in view of Bouras (US 5,906,682).

As for claim 36, Ciardella discloses the discharging head (nozzle 70 and subelements - see Figure 3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Ciardella is capable of being used to control said discharging head and said drive mechanism such that the first surface of the semiconductor wafer is covered by said raw sealant resin except a tip portion of said protruded-shaped electrode.

However, while Ciardella does disclose a semiconductor substrate (circuit board 35), Ciardella is silent as to the details of the circuit board. Ciardella is also silent as to the electrode shape, although the electrode is part of the substrate and provides no patentable weight.

Bouras, which discloses an improvement of Ciardella, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Bouras as incorporated discloses that at least one electrode has a protruded shape (as seen in Figures 1 and 2). Therefore, one in the art would appreciate that the claimed substrate can be used with Ciardella. One in the art would utilize the claimed substrate in order to properly coat the substrate and to reduce the need for multiple versions of similar apparatus. Therefore, it would

have been obvious to one of ordinary skill in the art at the time of the invention to have utilized such a substrate with the apparatus of Ciardella in order to reduce apparatus costs.

As for claim 40, Ciardella discloses the discharging head (nozzle 70 and subelements - see Figure 3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Ciardella also discloses a heater (see column 6, lines 64-67 and column 7, lines 1-19) for heating said raw sealant resin contained in said resin container unit.

However, while Ciardella does disclose a semiconductor substrate (circuit board 35), Ciardella is silent as to the details of the circuit board.

Bouras, which discloses an improvement of Ciardella, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Therefore, one in the art would appreciate that the claimed substrate can be used with Ciardella. One in the art would utilize the claimed substrate in order to properly coat the substrate and to reduce the need for multiple versions of similar apparatus. Therefore, it would have been obvious to one of

ordinary skill in the art at the time of the invention to have utilized such a substrate with the apparatus of Ciardella in order to reduce apparatus costs.

13. Claims 5, 9, 27 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouras and Ciardella '777 and further in view of Nakazawa (US 5,935,375).

It should be noted that the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras.

As to claim 5 and 27, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant

resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36).

Bouras and Ciardella '777 do not disclose two different discharging means.

Nakazawa discloses using a discharging mechanism is provided with a plurality of discharging nozzles (see Figures 7A, 7B, 8A, and 8B). The discharging nozzle of Nakazawa meet the limitation of being two different kinds of discharging mechanisms, heads or means.Nakazawa discloses that different nozzle sizes can be used in order minimize the differences in the rate of resin dispensing, so that the formation of resin-less voids is deterred (column 4, lines 26-45). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized multiple nozzles as in Nakazawa in order to avoid resin-less voids.

As to claim 9, the control unit of Bouras is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 9 above.

14. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989), and in view of Prentice (US 6,007,631).

As to claim 5 and 27, Ciardella discloses an apparatus (see Figure 5) for manufacturing a semiconductor device, comprising: a substrate holding unit/means (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22) which is explicitly means for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism or means (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit or means (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device or means for (item 16 and 44) that captures and provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the

nozzle, and therefore provides and is capable of providing the control unit functionality as claim, such as the position. The camera is capable of capturing the image prior to discharge. The apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin.

Ciardella does not disclose at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Prentice discloses at least two kinds of discharging mechanisms, heads or means, (see Figure 5) each being capable of discharging respective different amounts of raw sealant resin. Prentice discloses that such multiple mechanisms allow for parallel processing of the substrates (see abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to achieve parallel processing.

As to claim 9 and 31, the control unit of Ciardella is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

15. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouras and Ciardella '777 and further in view of Prentice (US 6,007,631).

It should be noted that the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras.

As to claim 5, 27 and 39, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of

Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36).

Bouras and Ciardella '777 do not disclose two different discharging means, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Prentice discloses at least two kinds of discharging mechanisms, heads or means, (see Figure 5) each being capable of discharging respective different amounts of raw sealant resin. Prentice discloses that such multiple mechanisms allow for parallel processing of the substrates (see abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to achieve parallel processing.

As to claim 9 and 31, the control unit of either Ciardella '777 and/or Bouras is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

16. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989), and in view of Cavallaro (US 6,017,392).

As to claim 5 and 27, Ciardella discloses an apparatus (see Figure 5) for manufacturing a semiconductor device, comprising: a substrate holding unit/means (conveyor and fixer - see lift

and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22) which is explicitly means for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism or means (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit or means (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device or means for (item 16 and 44) that captures and provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim, such as the position. The camera is capable of capturing the image prior to discharge. The apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin.

Ciardella does not disclose at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Cavallaro discloses at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin. Cavallaro discloses that each mechanism can be connected to or include different types of nozzles and/or dispense different types of liquids (column 2). Cavallaro discloses that this system allows for the assembly to dispense at different locations without it being necessary to move the entire pump assembly every time a dot is dispensed. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to dispense at multiple locations without moving the entire assembly.

As to claim 9 and 31, the control unit of Ciardella is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

17. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouras and Ciardella '777 and further in view of Cavallaro (US 6,017,392).

It should be noted that the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras.

As to claim 5, 27 and 39, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate

(i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36).

Bouras and Ciardella '777 do not disclose two different discharging means, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Cavallaro discloses at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin. Cavallaro discloses that each mechanism can be connected to or include different types of nozzles and/or dispense different types of liquids (column 2). Cavallaro discloses that this system allows for the assembly to dispense at different locations without it being necessary to move the entire pump assembly every time a dot is dispensed. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to dispense at multiple locations without moving the entire assembly.

As to claim 9 and 31, the control unit of Ciardella '777 and/or Bouras is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Alternate Claim Rejections - 35 USC § 103

18. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

19. These rejections are based on the interpretation that the excluding of electrode in the dispensing of the sealant (alternatively expressed as the similar limitation of "excluding a portion of said electrode", or covered…except for a tip portion of said protruded shape electrode" should be interpreted as a relevant limitation and not as intended use.

20. Claims 41-44 are alternatively rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989) and Sahara (US 6,713,880).

As to claim 41, Ciardella discloses an apparatus (see Figure 2) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3 and 5) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is *capable* of being provided with at least one electrode formed on a first surface thereof, a discharging mechanism (Figure 4) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (see entire specification for numerous instances of viscous) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said viscous material (such as a raw sealant resin) is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The camera is capable of capturing the image prior to discharge. The apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous

material including raw sealant resin. The apparatus of Ciardella is capable of performing the intended use of dispensing such that a resin layer having an uneven surface structure is formed from the raw sealant resin.

Ciardella does not disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate such that a portion of said electrode is excluded from said layer. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excepted from said layer" in order to achieve

a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claims 42, 43, and 44, Ciardella is capable of being used to perform the operation of dispensing to form a concave structure, an uneven surface structure of predetermined shape, or an uneven surface structure which comprises a thickness of approximately 15 micrometers, having concave portions of approximately 20 micrometers deep.

Furthermore, Sahara suggests that these numerical limitations are obvious.

With respect to claim 42, Sahara teaches a concave structure (see Figure 2B), and discloses motivation for doing so (mounting reliability is improved, see column 10, line 19-21). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used a concave structure for the uneven surface structure of the resin in order to improve mounting reliability.

With respect to claim 43, Sahara as incorporated teaches that the structure is a predetermined shape, concave (or with raised fillet portions). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used a predetermined shape such as the concave structure for the uneven surface structure of the resin in order to improve mounting reliability.

With respect to claim 44, Sahara as incorporated teaches that the protruded electrodes can be projected 1 to 200 micrometers from the resin, ideally 50 micrometers. Additionally, Sahara suggests a fillet portion can also be beyond that range (see Figure 2B, column 10, lines 8-21),

and that the thickness of this underfill resin layer is 0.15 mm to 0.25 mm (150 to 250 microns; see column 12, lines 28-35). Furthermore, optimization of prior art conditions, or routine experimentation, is obvious (MPEP 2144.05). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have optimize these parameters to achieve the claimed dimensions.

21. Claims 36, 40, and 41-44 are alternatively rejected under 35 U.S.C. 103(a) as being unpatentable over Bouras (US 5,906,682), Ciardella '777 (US 5,505,777) and Sahara (US 6,713,880). It should be noted that the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras, which is explicit motivation to combine the teachings of Bouras and Ciardella.

As to claim 36, Bouras, which discloses an improvement of Ciardella '777, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Ciardella '777 discloses the discharging head (nozzle 70 and subelements - see Figure 3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the

nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Bouras discloses that at least one electrode has a protruded shape (as seen in Figures 1 and 2). Additionally, Bouras and Ciardella '777 is capable of being used to control said discharging head and said drive mechanism such that the first surface of the semiconductor wafer is covered by said raw sealant resin except a tip portion of said protruded-shaped electrode.

In any event, Bouras does not explicitly disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate except for a tip portion of said protruded shaped electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excepted from said layer" in order to achieve a semiconductor device with high density in the

form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 40, Bouras, which discloses an improvement of Ciardella '777, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Ciardella '777 discloses the discharging head (nozzle 70 and subelements - see Figure 3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Bouras (item 26) and Ciardella '777 disclose a heater (see column 6, lines 64-67 and column 7, lines 1-19) for heating said raw sealant resin contained in said resin container unit.

In any event, Bouras does not explicitly disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate except for a tip portion of said protruded shaped electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a

resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excepted from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 41, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof

(chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36). The apparatus of Bouras is capable of performing the intended use of dispensing such that a resin layer having an uneven surface structure is formed from the raw sealant resin.

However, Bouras does not disclose explicitly forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate such that a portion of said electrode is excluded from said layer. However, Sahara discloses these critical features. Specifically, Figure

1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excepted from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claims 42, 43, and 44, Bouras is capable of being used to perform the operation of dispensing to form a concave structure, an uneven surface structure of predetermined shape, or

an uneven surface structure which comprises a thickness of approximately 15 micrometers, having concave portions of approximately 20 micrometers deep.

Furthermore, Sahara suggests that these numerical limitations are obvious.

With respect to claim 42, Sahara teaches a concave structure (see Figure 2B), and discloses motivation for doing so (mounting reliability is improved, see column 10, line 19-21). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used a concave structure for the uneven surface structure of the resin in order to improve mounting reliability.

With respect to claim 43, Sahara as incorporated teaches that the structure is a predetermined shape, concave (or with raised fillet portions). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used a predetermined shape such as the concave structure for the uneven surface structure of the resin in order to improve mounting reliability.

With respect to claim 44, Sahara as incorporated teaches that the protruded electrodes can be projected 1 to 200 micrometers from the resin, ideally 50 micrometers. Additionally, Sahara suggests a fillet portion can also be beyond that range (see Figure 2B, column 10, lines 8-21), and that the thickness of this underfill resin layer is 0.15 mm to 0.25 mm (150 to 250 microns; see column 12, lines 28-35). Furthermore, optimization of prior art conditions, or routine experimentation, is obvious (MPEP 2144.05). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have optimize these parameters to achieve the claimed dimensions.

22. Claims 5, 9, 27 and 31 are alternatively rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989), and Nakazawa (US 5,935,375) and Sahara (US 6,713,880).

As to claim 5 and 27, Ciardella discloses an apparatus (see Figure 5) for manufacturing a semiconductor device, comprising: a substrate holding unit/means (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22) which is explicitly means for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism or means (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit or means (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device or means for (item 16 and 44) that captures and provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim,

such as the position. The camera is capable of capturing the image prior to discharge. The apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin.

Ciardella does not disclose that said discharging mechanism is provided with a plurality of discharging nozzles.

Nakazawa discloses using a discharging mechanism is provided with a plurality of discharging nozzles (see Figures 7A, 7B, 8A, and 8B). Nakazawa discloses that different nozzle sizes can be used in order minimize the differences in the rate of resin dispensing, so that the formation of resin-less voids is deterred (column 4, lines 26-45). The discharging nozzle of Nakazawa meet the limitation of being two different kinds of discharging mechanisms, heads or means. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized multiple nozzles as in Nakazawa in order to avoid resin-less voids.

Ciardella does not disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate excluding said at least a portion of said electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see

Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 9, the control unit of Ciardella capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 5 and 9 above. Applicant successfully invokes means plus function for the limitations, but the various means correspond very similarly to the limitations of claim 5 and 9 above and are rejected for that reason.[1]

23. Claim 36 and 40 are alternatively rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989) and further in view of Bouras (US 5,906,682) and Sahara (US 6,713,880)

As for claim 36, Ciardella discloses the discharging head (nozzle 70 and subelements - see Figure 3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Ciardella is capable of being used to control said discharging head and said drive mechanism such that the first surface of the semiconductor wafer is covered by said raw sealant resin except a tip portion of said protruded-shaped electrode.

[1] For example, substrate holding means of claim 31 corresponds with substrate holding unit of claim 5, the means for discharging in claim 31 corresponds to the discharging mechanism of claim 5, the drive means for displacing of claim 31 corresponds to the drive mechanism of claim 5, the means for controlling of claim 31 corresponds to the control unit of claim 5, the means for capturing image information AND means for providing image information of claim 31 corresponds to the image formation device of claim 31, and the means for calculating a position of claim

However, while Ciardella does disclose a semiconductor substrate (circuit board 35), Ciardella is silent as to the details of the circuit board. Ciardella is also silent as to the electrode shape, although the electrode is part of the substrate and provides no patentable weight.

Bouras, which discloses an improvement of Ciardella, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Bouras as incorporated discloses that at least one electrode has a protruded shape (as seen in Figures 1 and 2). Therefore, one in the art would appreciate that the claimed substrate can be used with Ciardella. One in the art would utilize the claimed substrate in order to properly coat the substrate and to reduce the need for multiple versions of similar apparatus. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized such a substrate with the apparatus of Ciardella in order to reduce apparatus costs.

Ciardella does not disclose controlling such that said first surface of the semiconductor wafer substrate is covered by raw sealant resin except for a tip portion of said protruded shape electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that

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31 also corresponds to the control unit of claim 5 which performs these additional functions, and the additional

one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer and this portion is a tip portion, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As for claim 40, Ciardella discloses the discharging head (nozzle 70 and subelements - see Figure 3), the resin container unit (syringe 84), the drive mechanism (conveyor 22 and XYZ electromechanical positioner 38), and control unit (items 18, 38, 40, and 42) for controlling the discharging head and the drive mechanism (see rejection of claim 1 and 23 above) and wherein the substrate is held in a substrate holding unit (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40). The camera and vision circuit is an image

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elements of the amount and the two kinds of discharging being in claim 5 and 9 as well.

information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. Ciardella also discloses a heater (see column 6, lines 64-67 and column 7, lines 1-19) for heating said raw sealant resin contained in said resin container unit.

However, while Ciardella does disclose a semiconductor substrate (circuit board 35), Ciardella is silent as to the details of the circuit board.

Bouras, which discloses an improvement of Ciardella, further discloses that a similar semiconductor wafer substrate (either of chip 10 or circuit board 16), the semiconductor wafer substrate having at least one electrode (items 12 and 14) on a first surface thereof. Therefore, one in the art would appreciate that the claimed substrate can be used with Ciardella. One in the art would utilize the claimed substrate in order to properly coat the substrate and to reduce the need for multiple versions of similar apparatus. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized such a substrate with the apparatus of Ciardella in order to reduce apparatus costs.

Ciardella does not disclose controlling such that said first surface of the semiconductor wafer substrate is covered by raw sealant resin "excluding one electrode". However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2.

It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer and this portion is a tip portion, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

24. Claims 5, 9, 27 and 31 are alternatively rejected under 35 U.S.C. 103(a) as being unpatentable over Bouras and Ciardella '777 and further in view of Nakazawa (US 5,935,375) and Sahara (US 6,713,880).

It should be noted that the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras.

As to claim 5 and 27, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of

viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36).

Bouras and Ciardella '777 do not disclose two different discharging means.

Nakazawa discloses using a discharging mechanism is provided with a plurality of discharging nozzles (see Figures 7A, 7B, 8A, and 8B). The discharging nozzle of Nakazawa meet the limitation of being two different kinds of discharging mechanisms, heads or means.Nakazawa discloses that different nozzle sizes can be used in order minimize the differences in the rate of resin dispensing, so that the formation of resin-less voids is deterred (column 4, lines 26-45). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized multiple nozzles as in Nakazawa in order to avoid resin-less voids.

Bouras and Ciardella does not disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate excluding said at least a portion of said electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the

electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 9, the control unit of Bouras is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 5 and 9 above. Applicant successfully invokes means plus function for the limitations, but the various means correspond very similarly to the limitations of claim 5 and 9 above and are rejected for that reason. See especially Footnote 1 for an analysis of the similarities between claim 31 and claim 5 and 9.

25. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989), and in view of Prentice (US 6,007,631) and Sahara (US 6,713,880).

As to claim 5 and 27, Ciardella discloses an apparatus (see Figure 5) for manufacturing a semiconductor device, comprising: a substrate holding unit/means (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22) which is explicitly means for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism or means (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit or means (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device or means for (item 16 and 44) that captures and provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim, such as the position. The camera is capable of capturing the image prior to discharge. The

apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin.

Ciardella does not disclose at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Prentice discloses at least two kinds of discharging mechanisms, heads or means, (see Figure 5) each being capable of discharging respective different amounts of raw sealant resin. Prentice discloses that such multiple mechanisms allow for parallel processing of the substrates (see abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to achieve parallel processing.

Ciardella does not disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate excluding said at least a portion of said electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill

layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 9 and 31, the control unit of Ciardella is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 5 and 9 above. Applicant successfully invokes means plus function for the limitations, but the various means correspond very similarly to the limitations of claim 5 and 9 above and are rejected for that reason. See especially the analysis in Footnote 1.

26. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouras and Ciardella '777 and further in view of Prentice (US 6,007,631) and Sahara (US 6,713,880).

It should be noted that the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras.

As to claim 5, 27 and 39, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a

portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36).

Bouras and Ciardella '777 do not disclose two different discharging means, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Prentice discloses at least two kinds of discharging mechanisms, heads or means, (see Figure 5) each being capable of discharging respective different amounts of raw sealant resin. Prentice discloses that such multiple mechanisms allow for parallel processing of the substrates (see abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to achieve parallel processing.

Bouras and Ciardella does not disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate excluding said at least a portion of said electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer"

as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 9 and 31, the control unit of either Ciardella '777 and/or Bouras is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 5 and 9 above. Applicant successfully invokes means plus function for the limitations, but the various means correspond very similarly to the limitations of claim 5 and 9 above and are rejected for that reason. See especially the analysis in Footnote 1.

27. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ciardella (US 5,711,989), and in view of Cavallaro (US 6,017,392) and Sahara (US 6,713,880).

As to claim 5 and 27 and 39, Ciardella discloses an apparatus (see Figure 5) for manufacturing a semiconductor device, comprising: a substrate holding unit/means (conveyor and fixer - see lift and lock mechanism in column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22) which is explicitly means for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column 8, lines 8-10) contained in a viscous material container unit (syringe 84) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism or means (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit or means (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least

a portion of said electrode. The camera and vision circuit is an image information device or means for (item 16 and 44) that captures and provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim, such as the position. The camera is capable of capturing the image prior to discharge. The apparatus of Ciardella, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin.

Ciardella does not disclose at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Cavallaro discloses at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin. Cavallaro discloses that each mechanism can be connected to or include different types of nozzles and/or dispense different types of liquids (column 2). Cavallaro discloses that this system allows for the assembly to dispense at different locations without it being necessary to move the entire pump assembly every time a dot is dispensed. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to dispense at multiple locations without moving the entire assembly.

Ciardella does not disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate excluding said at least a portion of said electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation

comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 9 and 31, the control unit of Ciardella is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw

sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 5 and 9 above. Applicant successfully invokes means plus function for the limitations, but the various means correspond very similarly to the limitations of claim 5 and 9 above and are rejected for that reason. See especially the analysis in Footnote 1.

28. Claims 5, 9, 27, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouras and Ciardella '777 and further in view of Cavallaro (US 6,017,392) and Sahara (US 6,713,880).

It should be noted that the Bouras reference incorporates by reference the US 5,505,777 to Ciardella reference in column 3, lines 62-65 of Bouras.

As to claim 5, 27 and 39, Bouras and Ciardella '777 discloses an apparatus (see Figure 5 of Bouras, Figure 2 of Ciardella '777) for manufacturing a semiconductor device, comprising: a substrate holding unit (conveyor and fixer - see lift and lock mechanism in Ciardella '777, column 3, lines 5-13 and column 5, lines 36-40) for holding a semiconductor wafer substrate (i.e., a circuit board with semiconductor elements thereon, see columns 1-10), wherein said semiconductor wafer substrate is capable of being provided with at least one electrode formed on a first surface thereof (chip 10, solder balls 12, etc), a discharging mechanism (syringe 20 and dispensing needle 22, see also Figure 3 of Ciardella '777) which is explicitly for discharging droplets (see abstract, which recites "drop generator") of viscous material (for example, column

8, lines 8-10) contained in a viscous material container unit (syringe 20 of Bouras, syringe 84 of Ciardella '777) through at least one discharging nozzle (nozzle 70) onto said first surface of said semiconductor wafer substrate held on said substrate holding unit; a drive mechanism (conveyor 22 and XYZ electromechanical positioner 38) for displacing at least one of said semiconductor wafer substrate and said discharging nozzle; and a control unit (items 18, 38, 40, and 42) for controlling said discharging mechanism and said drive mechanism such that said raw sealant resin is attached to said first surface of said semiconductor wafer substrate except at least a portion of said electrode. The camera and vision circuit is an image information device (item 16 and 44) that provides image information of the substrate (such as the location of the drops), and effectively allows for the positioning of the drive mechanism of the nozzle, and therefore provides and is capable of providing the control unit functionality as claim. The apparatus of Bouras, disclosed as dispensing viscous material, is capable of dispensing any sub-species of viscous material including raw sealant resin. Bouras explicitly discloses capturing image information of the substrate prior to discharge (see column 6, lines 18-36).

Bouras and Ciardella '777 do not disclose two different discharging means, heads or means, each being capable of discharging respective different amounts of raw sealant resin.

Cavallaro discloses at least two kinds of discharging mechanisms, heads or means, each being capable of discharging respective different amounts of raw sealant resin. Cavallaro discloses that each mechanism can be connected to or include different types of nozzles and/or dispense different types of liquids (column 2). Cavallaro discloses that this system allows for the assembly to dispense at different locations without it being necessary to move the entire pump assembly every time a dot is dispensed. Therefore, it would have been obvious to one of

ordinary skill in the art at the time of the invention to have two discharging mechanisms in order to dispense at multiple locations without moving the entire assembly.

Bouras and Ciardella does not disclose forming a layer of said raw sealant resin on a first surface of said semiconductor wafer substrate excluding said at least a portion of said electrode. However, Sahara discloses these critical features. Specifically, Figure 1A and 1B show a semiconductor wafer substrate. This substrate is provided with at least one electrode formed on a first surface thereof, such as solder ball 12. This substrate is then subjected to a resin sealing operation comprising "forming a layer of said raw sealant resin on said first surface of said semiconductor wafer substrate such that a portion of said electrode is excepted from said layer" as shown in Figure 2. It is noted that the underfill layer can be an epoxy resin (as recited in column 7, lines 17-22). It is noted that the underfill layer can have a concave shape, and that one would be motivated to do so in order to include a fillet portion which improves mounting reliability (see Figure 2B; see also column 10, lines 8-21). It is also note that a portion of the electrode is excepted from the raw sealant layer, as the electrode 12 is shown to protrude from the underfill layer. Sahara discloses that this process achieves a semiconductor device with high density in the form of a chip suitable for mounting on a substrate (see column 10, lines 28-30), which is especially shown by the use of this substrate in Figures 5A-5C. Sahara additionally discloses that this substrate achieves reliable connections (see column 13, lines 47-49), and reduces the amount of sealant resin such as underfill needed (see column 13, lines 41-47). And Ciardella discloses a control system designed to dispense as desired. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have leave portions of the electrodes "excluded from said layer" in order to achieve a semiconductor device with

high density in the form of a chip suitable for mounting on a substrate and additionally in order to achieve reliable connections and additionally to reduce the amount of resin needs.

As to claim 9 and 31, the control unit of Ciardella '777 and/or Bouras is capable of said control unit controls said discharging mechanism and said drive mechanism such that a first discharging mechanism of said at least two kinds of discharging mechanisms is capable of discharging droplets of raw sealant resin of an amount smaller than other discharging mechanisms used for discharging said raw sealant resin for an area in a vicinity of said electrode.

Similarly, claim 31 is rejected under the same grounds as claim 5 and 9 above. Applicant successfully invokes means plus function for the limitations, but the various means correspond very similarly to the limitations of claim 5 and 9 above and are rejected for that reason. See especially the analysis in Footnote 1.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George R. Koch III whose telephone number is (571) 272-1230 (TDD only). If the applicant cannot make a direct TDD-to-TDD call, the applicant can communicate by calling the Federal Relay Service at 1-866-377-8642 and giving the operator the above TDD number. The examiner can also be reached by E-mail at george.koch@uspto.gov in accordance with MPEP 502.03. The examiner can normally be reached on M-F 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Philip Tucker can be reached on (571) 272-1095. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/George R. Koch III/
Primary Examiner, Art Unit 1791

11/9/2008